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Yellowtail flounder, redfish (*Sebastes spp.*) and witch flounder indices from the Spanish Survey conducted in Divisions 3NO of the NAFO Regulatory Area

by

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Abstract

Since 1995, Spain carries out a spring stratified random bottom trawl survey in Div. 3NO of the NAFO Regulatory Area. Total mean catches, biomass and mean numbers for yellowtail flounder (*Limanda ferruginea*) are presented for the period 1995-2015, for redfish (*Sebastes spp.*) for the period 1997-2015 and for witch flounder (*Glyptocephalus cynoglossus*) for the period 2002-2015. Detailed indices are presented from 2011. Yellowtail flounder indices do not show a clear trend. Biomass increased from 1997 to 1999 and then remained almost constant throughout all the period, decreasing slightly in 2014 and 2015. Redfish indices oscillate greatly over time, probably because the gear does not sample adequately aggregating pelagic species. There was a sharp increase in 2009 and since then has maintained higher values than before 2009, comprising the 3N around the 90% of the total biomass in the last years. In 2014 all indices decreased, increased again in 2015 in both Divisions. Good year classes have not been registered recently. Witch flounder is very scarce and its indices show a general decreasing trend throughout the period (2002-2015) remaining at very low levels. Recruitment was quite good at the beginning of the series but very poor in recent years.

Material and methods

The Spanish Spring (May/June) survey in Div. 3NO of NAFO Regulatory Area was initiated by Spain in 1995. Until 2001, the survey was carried out on board the Spanish vessel C/V *Playa de Mendiña* (338 GT and 800 HP) using a *Pedreira* type bottom trawl. The R/V *Vizconde de Eza* replaced the C/V *Playa de Mendiña* in 2001, and the *Campelen* 1800 was implemented as survey gear. The main specifications and geometry of these gears, their rigging profile and the net plan, and the survey technical information are described in Walsh *et al.* (2001). The survey area was stratified following the standard stratification schemes (Bishop, 1994). Set number was allocated proportionally to the area of the strata, with a minimum of two planned hauls per stratum, and trawl positions were chosen at random (Doubleday, 1981). Biomass indices were calculated by the swept area method (Cochran, 1997), assuming catchability factor of 1. Table 1 presents the number of valid tows, the depth strata covered and the dates of the total survey series. Table 2 shows the swept area and number of hauls by stratum for the last five years (2011-2015). To know the results of the rest of the years, see González-Troncoso *et al.*, 2013. More information on the calibration method can be found in González-Troncoso *et al.* (2004) and Paz *et al.* (2004).

In each haul, all the individuals caught were sorted by species and weighted. Random samples of the catch of each species were length measured (total length) to the nearest lower cm. The obtained length distribution was aggregated into 2 cm intervals (beginning with the pair number) and raised to the catch of each species.

The redfish series for total biomass and total mean catches and mean number per tow start in 1997 because sampling depth in 1995 and 1996 was shallower than 1000 meters so the data are not representative for this species. As all strata where the yellowtail flounder is caught were well surveyed, the series for this species are presented since 1995. As calibration for witch flounder data has not been done yet, only data from 2002 to 2014 are presented. Data for yellowtail flounder and redfish were calibrated for the period 1995-2000 and non-transformed from 2002 onwards, to create a combined 1995-2015 time-series. Regarding 2001, there are both calibrated (from the former vessel) and non-transformed data (from the new vessel).

Mean catch and variance per haul, biomass and length distribution by strata are presented for each species for the last five years (2011-2015). To see the results of the rest of the years, see González-Troncoso *et al.*, 2013. Total biomass and mean catch per tow with SD and mean number per tow by year are presented for the total period series.

Figure 1 presents the maps with the distribution of the catches of the three species during the 2015 Spanish 3NO survey.

Results

Yellowtail flounder

After a moratorium between 1994 and 1997, the yellowtail flounder fishery has been under TAC. According to the Report of NAFO Scientific Council Meeting, stock size reached a minimum in the mid 1990's, but since 1994 has steadily increased and is now well above B_{msy} . There is very low risk of the stock being below B_{msy} or F being above F_{msy} . Recent recruitment appears to be lower than average (NAFO, 2015).

Mean Catches and Biomass

Table 3 shows mean catch and SD per haul and stratum and Table 4 the biomass estimates by the swept area method and their SD by stratum for years 2011-2015 for yellowtail flounder. Total biomass (t) and stratified mean catch per tow (kg) and SD by year for the entire series are presented in Table 5 for 1995-2015. Table 6 presents the parameters a and b for the calculation of the length-weight relationship for years 2011-2015.

Yellowtail flounder biomass index shows no clear trend throughout the study period. It increased substantially from 1997 to 1999, has maintained almost constant values until 2013 and then decreased slightly in 2014 and 2015 (Table 5; Figures 2 and 3).

Length Distribution

The mean number per haul by year is presented in Table 7 and Figure 2 for 1995-2015 and Table 8 presents the same index by length, sex and year besides the sampled size and catch for the period 2011-2015. Figures 4 and 5 present these indices for the entire period. The mean numbers are in concordance with the mean catches (Figure 2). There has not been good recruitment in recent years. In Figure 4, we can follow a length modal value since the beginning of the series, but the presence of juveniles is very low. This mode can be seen until 2009 when it reached 34-35 cm, and since 2010 the mode of the length distribution was about 30-34 cm. In 2012-2015 the mode was at 34 cm for females, and at 30-31 cm for males.

Redfish

There are two species of redfish that have been commercially fished in Div. 3NO; the deep-sea redfish (*Sebastes mentella*) and the Acadian redfish (*Sebastes fasciatus*). Due to the difficulty to distinguish the two species, the catches are usually reported by genus as "redfish" (*Sebastes spp.*) in the commercial fishery statistics.

This stock in Div. 30 has been under TAC regulation since 1974. In September 2004, the Fisheries Commission adopted an annual TAC of 20 000 t in the entire area of Div. 30. The stock appears to have increased since the early 2000s. Catches were stable from 2009 to 2014. Survey indices increased or remained stable between years during the period 2009 to 2012, fell to below 2009 levels in 2013, but increased above 2009 levels in spring 2014. Persistent and high variability in the indices makes it difficult to reconcile year to year changes. Current fishing mortality proxy is low.

In 3N (the stock is 3LN) a moratorium was implemented from 1998 to 2009. The fishery was reopened in 2010 with the resultant increase of catches but the perception of the stock given by the available surveys has not been altered. There is a low risk of the stock being below B_{msy} . The probability of being above F_{msy} is very low. Recent recruitment (2005-2013) appears to be above average (NAFO, 2015).

Mean Catches and Biomass

Redfish mean catches and SD are presented in Table 9 and biomass in Table 10 by stratum for 2011-2015. Annual biomass and stratified mean catch and SD per haul for years 1997-2015 are presented in Table 11 by Division. The length-weight relationship parameters a and b are presented in Table 12 for years 2011-2015.

Redfish indices oscillate greatly over time, probably because the gear does not sample adequately aggregating pelagic species. They showed a quick increase from 1997 to 2000, followed by a sudden drop until 2002, after which they have increased to the levels of the early years of the time series. The index increased nearly fivefold in 2009 in comparison with 2005. This was not just due to very large catches in few hauls, as redfish catch was over 1 ton in 11 of the 43 hauls in which redfish was caught. Furthermore, redfish catch was over 15 tons in three hauls. In 2015 an increased allowed biomass to reach the second highest value of the series. In this case, redfish catch was over 10 tons in 3 hauls (Table 10; Figures 6 and 7).

Biomass and mean catch per haul and Division, the number of strata covered in each case, and the percentage of biomass in 3N respect to the total are presented in Table 11. Biomass is always larger in 3N than in 30 (Figure 8), although the percentage is very spread over the time. Since 2005, more than 83% of redfish catches have occurred in Division 3N. However, the mean catch per tow is usually higher in Division 30. In 2010, mean catch per tow in 30 was almost four times higher than in 2009, whereas in 3N was lower than in 2009. Total biomass in 3NO increased, due to the increase in 3N. In 2013 the increase in the total biomass seems to be because the increase in Division 3N. In 2014, all indices decreased and increased again in 2015 in both Divisions.

Length Distribution

Mean number per haul by year is presented in Table 13 and Figure 6 for 1997-2015. Table 14 presents this index per length with sample size and catch for the period 2011-2015. Figures 9 and 10 show the trend of the mean abundance per tow by length class. The y-axis upper limit of Figure 10 has been changed for years 1997-2008 to see the length distribution despite the large catches registered in the period 2009-2015. The last good year class was recorded in 2004 and this cohort can be tracked until 2015. In recent years there is only a discrete presence of juveniles. The clear 18 cm mode (20 cm in 2011) in 2009 seems to be a consequence of the 2004 recruitment. In 2012 and 2013 the mode is in 20 cm and in 20-22 cm in 2014 and 2015.

Witch flounder

This stock occurs mainly in Div. 30, along the South-western slopes of the Grand Bank, but it seems to migrate seasonally onto the shallow banks. It has been fished mainly in winter and springtime, targeting the spawning concentrations. The Div. 3NO estimates of biomass index for the Canadian surveys, although variable, have shown a general decreasing trend from 1985 to 1998 followed by an increase from 1998 to 2003. From 2010 to 2014 the index increased to values near the series high from 1987.

Recruitment (fish less than 21 cm) has been low since 2002, although there were above average peaks indicated for spring recruitment in 2009 and 2013. The stock size has steadily increased since 1999 and is now at 81% B_{msy} . There is very low risk (<1%) of the stock being below B_{lim} or F being above F_{lim} . The stock is in the safe zone of the NAFO Precautionary Approach Framework. The stock was reopened to fishery in 2015 with a very low TAC (1 000 tons) (NAFO, 2015).

Mean Catches and Biomass

Witch flounder mean catches and SD by stratum are presented in Table 15 and biomass per stratum in Table 16 for 2011-2015. In Table 17 and Figures 11 and 12 the annual stratified mean catch per tow and biomass with SD are presented for the period 2002-2015. The length-weight relationship parameters a and b are presented in Table 18 for 2011-2015.

Witch flounder indices show a general decreasing trend throughout the period 2002-2015. Biomass fluctuated with very low values in 2002 to a depressed level in 2014, with an increase in 2015 that did not reach the 2013 level. Highest values were found in 2003, 2004 and 2010 (Table 15; Figures 11 and 12).

Length Distribution

Table 19 and Figures 13 and 14 present witch flounder mean number per tow and sex by year for 2002-2015, and Table 20 the same index by length with sample size and catch for the period 2011-2015. The best recruitment occurred in the period 2002-2005 and has been very poor since 2008. Some modes can be tracked in Figure 13, probably due to the recruitments at the beginning of the series. In 2012 and 2013 there was a quite good presence of individuals of lengths 34-42 cm, not found in 2014 or 2015.

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References

- Bishop, C A.. 1994. Revisions and additions to stratification schemes used during research vessel surveys in NAFO subareas 2 and 3. NAFO SCR Doc. 94/43, Serial n° N2413, 23 pp.
- Cochran, W. G.. 1997. Sampling techniques. J. Wiley and Sons, N.Y., 428 pp.
- Doubleday, W. G.. 1981. Manual on groundfish surveys in the Northwest Atlantic. NAFO Sci. Coun. Studies, 2, 55.
- González Troncoso, D., E. Guijarro-García and X. Paz. 2013. Yellowtail flounder, redfish (*Sebastes spp*) and witch flounder indices from the Spanish Survey conducted in Divisions 3NO of the NAFO Regulatory Area. NAFO SCR Doc. 13/11, Serial Number N6161, 44 pp.
- González Troncoso, D., X. Paz and C. González. 2004. Atlantic cod population indices obtained from the Spring surveys conducted by Spain in the NAFO Regulatory Area of Divisions 3NO, 1995-2003. NAFO SCR Doc. 04/12, Serial Number N4957, 21 pp.
- NAFO, 2015. Report of Scientific Council Meeting, 29 May-11 June 2015.
- Paz, X., D. González Troncoso and E. Román. 2004. New time series for Yellowtail flounder from the comparative experience between the C/V *Playa de Menduñá* and the R/V *Vizconde de Eza* in the NAFO Regulatory Area of Divisions 3NO, 1995-2003. NAFO SCR Doc. 04/10, Serial Number N4955, 19 pp.
- Walsh, J.S., X. Paz and P. Durán. 2001. A preliminary investigation of the efficiency of Canadian and Spanish Survey bottom trawls on the Southern Bank. NAFO SCR Doc., 01/74, Serial n° N4453, 18 pp.

Table 1. Spanish spring bottom trawl surveys in NAFO Div. 3NO: 1995-2015.

Year	Vessel	Valid tows	Depth strata covered (m)	Dates
1995	<i>C/V Playa de Mendiña</i>	77	42-684	May 18-May 29
1996	<i>C/V Playa de Mendiña</i>	112	41-1135	May 07-May 24
1997	<i>C/V Playa de Mendiña</i>	128	42-1263	April 26-May 18
1998	<i>C/V Playa de Mendiña</i>	124	42-1390	May 06-May 26
1999	<i>C/V Playa de Mendiña</i>	114	41-1381	May 07-May 26
2000	<i>C/V Playa de Mendiña</i>	118	42-1401	May 07-May 28
2001 ^(*)	<i>R/V Vizconde de Eza</i>	83	36-1156	May 03-May 24
	<i>C/V Playa de Mendiña</i>	121	40-1500	May 05-May 23
2002	<i>R/V Vizconde de Eza</i>	125	38-1540	April 29-May 19
2003	<i>R/V Vizconde de Eza</i>	118	38-1666	May 11-June 02
2004	<i>R/V Vizconde de Eza</i>	120	43-1539	June 06-June 24
2005	<i>R/V Vizconde de Eza</i>	119	47-1485	June 10-June 29
2005	<i>R/V Vizconde de Eza</i>	119	47-1485	June 10-June 29
2006	<i>R/V Vizconde de Eza</i>	120	45-1480	June 7-June 27
2007	<i>R/V Vizconde de Eza</i>	110	45-1374	May 29-June 19
2008	<i>R/V Vizconde de Eza</i>	122	45-1374	May 27-June 16
2009	<i>R/V Vizconde de Eza</i>	109	45-1374	May 31-June 18
2010	<i>R/V Vizconde de Eza</i>	95	45-1374	May 30-June 18
2011	<i>R/V Vizconde de Eza</i>	122	44-1450	June 5-June 24
2012	<i>R/V Vizconde de Eza</i>	122	44-1450	June 3-June 21
2013	<i>R/V Vizconde de Eza</i>	122	44-1450	June 1-June 21
2014	<i>R/V Vizconde de Eza</i>	122	44-1450	June 2-June 21
2015	<i>R/V Vizconde de Eza</i>	122	44-1450	May 31-June 19

(*)For the calculation of the series, 83 hauls were taken from the *R/V Vizconde de Eza* and 40 hauls from the *C/V Playa de Mendiña* (123 hauls in total)

Table 2. Swept area and number of hauls by stratum. Spanish Spring Surveys in NAFO Div. 3NO: 2011-2015. Swept area in square miles. n.s. means stratum not surveyed.

Stratum	2011		2012		2013		2014		2015	
	Swept area	Tow number	Swept area	Tow number	Swept area	Tow number	Swept area	Tow number	Swept area	Tow number
353	0.0349	3	0.0338	3	0.0349	3	0.0379	3	0.0401	3
354	0.0345	3	0.0338	3	0.0338	3	0.0394	3	0.0390	3
355	0.0233	2	0.0229	2	0.0225	2	0.0263	2	0.0263	2
356	0.0229	2	0.0225	2	0.0225	2	0.0266	2	0.0255	2
357	0.0225	2	0.0229	2	0.0236	2	0.0263	2	0.0233	2
358	0.0345	3	0.0330	3	0.0338	3	0.0390	3	0.0349	3
359	0.0806	7	0.0806	7	0.0829	7	0.0908	7	0.0855	7
360	0.2374	20	0.2344	20	0.2231	19	0.2629	20	0.2363	20
374	0.0225	2	0.0229	2	0.0233	2	0.0259	2	0.0229	2
375	0.0360	3	0.0349	3	0.0360	3	0.0390	3	0.0341	3
376	0.1178	10	0.1181	10	0.1305	11	0.1324	10	0.1159	10
377	0.0233	2	0.0229	2	0.0236	2	0.0259	2	0.0233	2
378	0.0240	2	0.0229	2	0.0225	2	0.0263	2	0.0225	2
379	0.0221	2	0.0225	2	0.0240	2	0.0255	2	0.0225	2
380	0.0229	2	0.0229	2	0.0229	2	0.0263	2	0.0229	2
381	0.0233	2	0.0221	2	0.0244	2	0.0259	2	0.0236	2
382	0.0450	4	0.0454	4	0.0484	4	0.0521	4	0.0458	4
721	0.0229	2	0.0233	2	0.0225	2	0.0266	2	0.0240	2
722	0.0225	2	0.0221	2	0.0221	2	0.0259	2	0.0259	2
723	0.0218	2	0.0225	2	0.0221	2	0.0259	2	0.0233	2
724	0.0233	2	0.0225	2	0.0225	2	0.0255	2	0.0236	2
725	0.0240	2	0.0225	2	0.0229	2	0.0255	2	0.0229	2
726	0.0225	2	0.0221	2	0.0221	2	0.0248	2	0.0229	2
727	0.0225	2	0.0233	2	0.0229	2	0.0259	2	0.0225	2
728	0.0229	2	0.0229	2	0.0233	2	0.0248	2	0.0225	2
752	0.0236	2	0.0229	2	0.0233	2	0.0240	2	0.0225	2
753	0.0225	2	0.0221	2	0.0236	2	0.0240	2	0.0233	2
754	0.0225	2	0.0221	2	0.0240	2	0.0225	2	0.0225	2
755	0.0454	4	0.0446	4	0.0454	4	0.0454	4	0.0450	4
756	0.0206	2	0.0221	2	0.0229	2	0.0229	2	0.0229	2
757	0.0236	2	0.0214	2	0.0240	2	0.0244	2	0.0229	2
758	0.0225	2	0.0221	2	0.0225	2	0.0221	2	0.0221	2
759	0.0218	2	0.0221	2	0.0225	2	0.0229	2	0.0229	2
760	0.0214	2	0.0225	2	0.0229	2	0.0364	3	0.0225	2
761	0.0236	2	0.0221	2	0.0225	2	0.0240	2	0.0240	2
762	0.0225	2	0.0225	2	0.0218	2	0.0229	2	0.0229	2
763	0.0349	3	0.0330	3	0.0341	3	0.0233	2	0.0341	3
764	0.0225	2	0.0225	2	0.0214	2	0.0259	2	0.0251	2
765	0.0225	2	0.0229	2	0.0221	2	0.0240	2	0.0236	2
766	0.0225	2	0.0225	2	0.0221	2	0.0221	2	0.0236	2
767	0.0233	2	0.0203	2	0.0218	2	0.0221	2	0.0229	2

Table 4. Yellowtail flounder survey biomass (t) by stratum in NAFO Div. 3NO: 2011-2015. n.s. means stratum not surveyed.

Strata	2011	2012	2013	2014	2015	Strata	2011	2012	2013	2014	2015
353	2366	214	806	23	688	725	0	0	0	0	0
354	16	15	17	0	43	726	0	0	0	0	0
355	0	2	0	0	0	727	0	0	0	0	0
356	0	0	0	0	0	728	0	0	0	0	0
357	0	0	0	0	0	752	0	0	0	0	0
358	8	7	0	0	0	753	0	0	0	0	0
359	6767	4384	6466	1305	78	754	0	0	0	0	0
360	90856	115943	114639	48586	67463	755	0	0	0	0	0
374	26552	16220	8549	8098	4118	756	0	0	0	0	0
375	11857	4858	8038	8355	4655	757	0	0	0	0	0
376	55789	48374	48457	70031	63736	758	0	0	0	0	0
377	2802	3549	639	84	65	759	0	0	0	0	0
378	0	0	0	3	0	760	0	0	0	0	0
379	0	0	0	0	0	761	0	0	0	0	0
380	0	0	0	0	0	762	0	0	0	0	0
381	0	0	152	0	0	763	0	0	0	0	0
382	6819	2038	207	0	0	764	0	0	0	0	0
721	0	0	0	0	0	765	0	0	0	0	0
722	0	0	0	0	0	766	0	0	0	0	0
723	0	0	0	0	0	767	0	0	0	0	0
724	0	0	0	0	0						

Table 5. Yellowtail flounder survey biomass (t) with SD and stratified mean catch per tow (kg) and SD by year in NAFO Div. 3NO: 1995-2015.

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Biomass	9264	43349	38697	122601	197012	144685	182704	148487	136775	169978	156472
SD	2484	6032	8527	31359	22938	19097	25847	23368	19287	18869	15271
MCPT	16.22	59.54	47.74	137.32	232.41	167.76	210.84	164.28	148.92	190.05	176.42
SD	4.37	8.41	10.69	34.70	27.41	22.21	30.58	24.92	20.84	21.27	17.06

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Biomass	160145	160731	160146	183412	189687	203833	195606	187969	136484	140845
SD	16458	18852	17297	25736	22611	30743	23679	22493	29519	18915
MCPT	189.32	202.64	178.27	209.43	224.54	231.22	221.33	214.17	173.79	159.25
SD	19.83	23.61	19.00	29.75	26.30	35.18	26.27	25.35	38.52	21.37

Table 6. Yellowtail flounder length weight relationships in Spanish Spring Surveys in NAFO Div. 3NO: 2011-2015. E(x) means Error of the parameter x.

Males							Females						Total					
Year	a	b	E (a)	E (b)	R2	N	a	b	E (a)	E (b)	R2	N	a	b	E (a)	E (b)	R2	N
2011	0.01213	2.87117	0.2513	0.0758	0.981	435	0.0063	3.0725	0.1587	0.0462	0.992	575	0.0080	3.0081	0.1225	0.0366	0.994	1015
2012	0.00940	2.94448	0.3281	0.1018	0.984	417	0.0047	3.1527	0.2378	0.0712	0.992	494	0.0048	3.1471	0.2299	0.0699	0.992	914
2013	0.00147	3.47842	0.8688	0.2588	0.866	436	0.0110	2.9156	0.1599	0.0463	0.991	588	0.0055	3.1012	0.2729	0.0839	0.968	1039
2014	0.01661	2.81259	0.1442	0.0449	0.993	354	0.0119	2.9123	0.1445	0.0428	0.992	506	0.0162	2.8240	0.1218	0.0383	0.993	861
2015	0.00491	3.16089	0.2087	0.0646	0.988	506	0.0069	3.0678	0.0797	0.0233	0.998	611	0.0066	3.0784	0.0242	0.0383	0.997	1144

Table 7. Yellowtail flounder mean number per tow by year in Spanish Spring surveys in NAFO Div. 3NO: 1995-2015. Indet. means indeterminate.

	1995				1996				1997				1998				1999				2000			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
MNPT	31.12	47.36	6.14	84.62	73.11	188.83	13.23	275.17	134.85	147.98	0.00	282.83	279.83	343.35	1.61	624.79	508.72	539.70	4.48	1052.90	332.06	376.36	0.00	708.42
	2001				2002				2003				2004				2005				2006			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
MNPT	328.27	428.33	6.98	763.57	256.56	333.09	0.81	590.46	215.96	271.49	0.72	488.17	322.91	336.03	1.19	660.14	275.52	308.25	0.30	584.07	281.15	354.69	0.60	636.44
	2007				2008				2009				2010				2011				2012			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
MNPT	317.34	365.53	0.10	682.97	295.11	335.10	0.15	630.35	298.01	398.88	0.48	697.37	368.83	414.09	0.00	782.92	305.92	426.42	0.00	732.34	315.50	438.48	0.75	754.73
	2013				2014				2015															
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total												
MNPT	294.58	394.06	0.79	689.43	226.69	293.78	0.03	520.50	219.81	248.70	0.11	468.62												

Table 8. Yellowtail flounder mean number per tow by length class and year. Spanish Spring Survey on NAFO 3NO: 2011-2015. Indet. means indeterminate.

Lenght (cm.)	2011				2012				2013				2014				2015			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.297	0.297	0.000	0.000	0.000	0.000	0.000	0.000	0.090	0.090
8	0.000	0.000	0.000	0.000	0.000	0.000	0.066	0.066	0.000	0.043	0.076	0.119	0.000	0.000	0.027	0.027	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.096	0.096	0.000	0.000	0.076	0.076	0.090	0.027	0.000	0.117	0.065	0.000	0.023	0.088
12	0.000	0.000	0.000	0.000	0.294	0.096	0.085	0.475	0.000	0.000	0.078	0.078	0.027	0.027	0.000	0.054	0.393	0.168	0.000	0.561
14	0.077	0.013	0.000	0.090	0.683	0.292	0.210	1.185	0.071	0.097	0.147	0.314	0.471	0.458	0.000	0.929	0.429	0.083	0.000	0.512
16	0.698	0.627	0.000	1.324	0.548	0.507	0.000	1.055	0.328	0.071	0.060	0.458	0.724	0.584	0.000	1.308	0.171	0.746	0.000	0.918
18	2.421	2.221	0.000	4.642	0.845	0.663	0.289	1.797	0.253	0.253	0.060	0.565	0.883	0.362	0.000	1.245	0.566	0.407	0.000	0.973
20	2.628	3.051	0.000	5.678	2.130	2.825	0.000	4.955	0.891	1.003	0.000	1.894	1.621	0.831	0.000	2.452	2.428	1.127	0.000	3.555
22	2.412	2.282	0.000	4.694	7.317	6.789	0.000	14.106	2.740	3.140	0.000	5.879	2.910	1.182	0.000	4.093	2.189	1.347	0.000	3.536
24	8.451	5.504	0.000	13.954	11.515	10.017	0.000	21.532	7.487	8.263	0.000	15.749	3.649	3.951	0.000	7.600	2.731	2.106	0.000	4.837
26	25.580	14.079	0.000	39.659	29.809	19.368	0.000	49.177	23.234	16.665	0.000	39.898	10.794	7.617	0.000	18.410	7.828	4.621	0.000	12.449
28	52.525	34.993	0.000	87.517	69.232	42.103	0.000	111.335	54.912	27.949	0.000	82.861	31.696	19.603	0.000	51.299	26.388	9.768	0.000	36.156
30	70.813	52.249	0.000	123.062	81.097	64.012	0.000	145.109	78.158	46.704	0.000	124.862	69.017	39.870	0.000	108.887	65.705	25.661	0.000	91.366
32	80.108	53.396	0.000	133.504	66.077	63.104	0.000	129.181	73.177	62.970	0.000	136.146	65.608	51.680	0.000	117.289	68.516	53.570	0.000	122.086
34	44.691	75.990	0.000	120.681	33.748	73.592	0.000	107.340	37.376	68.287	0.000	105.662	30.734	58.923	0.000	89.656	32.700	54.184	0.000	86.884
36	12.199	76.297	0.000	88.496	8.716	67.450	0.000	76.166	12.654	65.653	0.000	78.307	6.218	49.180	0.000	55.398	8.310	43.816	0.000	52.126
38	2.488	53.131	0.000	55.619	2.711	49.593	0.000	52.305	2.544	49.874	0.000	52.418	1.728	28.656	0.000	30.384	1.097	27.918	0.000	29.014
40	0.618	32.793	0.000	33.411	0.432	23.634	0.000	24.066	0.522	26.657	0.000	27.179	0.377	19.238	0.000	19.615	0.218	14.529	0.000	14.747
42	0.124	15.014	0.000	15.138	0.181	9.291	0.000	9.472	0.173	10.849	0.000	11.022	0.069	8.649	0.000	8.718	0.027	6.371	0.000	6.399
44	0.083	2.984	0.000	3.067	0.166	3.726	0.000	3.893	0.062	4.626	0.000	4.688	0.069	2.164	0.000	2.233	0.048	1.564	0.000	1.612
46	0.000	1.351	0.000	1.351	0.000	1.032	0.000	1.032	0.000	0.746	0.000	0.746	0.000	0.706	0.000	0.706	0.000	0.532	0.000	0.532
48	0.000	0.404	0.000	0.404	0.000	0.242	0.000	0.242	0.000	0.114	0.000	0.114	0.000	0.075	0.000	0.075	0.000	0.154	0.000	0.154
50	0.000	0.045	0.000	0.045	0.000	0.051	0.000	0.051	0.000	0.032	0.000	0.032	0.000	0.000	0.000	0.000	0.000	0.027	0.000	0.027
52	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
54	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.061	0.000	0.061	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
56	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
58	0.000	0.000	0.000	0.000	0.000	0.096	0.000	0.096	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	305.915	426.422	0.000	732.337	315.502	438.483	0.746	754.732	294.581	394.056	0.794	689.431	226.685	293.784	0.027	520.497	219.809	248.701	0.113	468.623
Nº samples:				50				52				48				45				44
Nº Ind.:	5500	6259	0	11759	4523	6150	10	10683	5314	6587	16	11917	3004	3975	1	6980	3831	4834	4	8669
Sampled catch:				3535				3104				3504				2217				3023
Range:				15-50				8-58				6-54				8-48				6-50
Total catch:				20193				18359				17513				14027				12
Total hauls:				122				122				122				122				122

Table 9. Redfish mean catch (kg) and SD by stratum. Spanish Spring Surveys in NAFO Div. 3NO: 2011-2015. n.s. means stratum not surveyed.

[illegible]

Table 10. Redfish survey biomass (t) by stratum in NAFO Div. 3NO: 2011-2015. n.s. means stratum not surveyed.

Strata	2011	2012	2013	2014	2015	Strata	2011	2012	2013	2014	2015
353	0	17	0	0	0	725	1031	2688	4739	712	5818
354	12568	13552	9444	478	18412	726	292	161	102	37	223
355	12456	10505	7269	1708	11017	727	367	135	2840	237	1769
356	39873	3107	9523	6972	2607	728	28	86	208	37	70
357	16336	26596	41850	5441	54832	752	9	8	25	1	0
358	262502	78425	122562	40393	324502	753	0	0	0	0	0
359	11103	1438	17272	38361	12297	754	0	0	7	0	0
360	0	0	30	7	0	755	0	0	6	0	0
374	0	0	0	0	0	756	1	6	0	5	6
375	0	0	0	0	0	757	0	0	3	4	3
376	1	0	0	0	0	758	0	0	0	0	0
377	0	0	69	0	0	759	0	0	0	0	0
378	62648	93021	198482	47113	76300	760	148	0	21	6	0
379	5892	14649	5409	21861	29023	761	0	0	0	0	0
380	37169	14288	11264	13034	9864	762	0	0	0	0	0
381	409	8239	40	0	308	763	16	0	0	0	0
382	0	0	0	0	0	764	26	0	0	1	0
721	4384	1568	2926	3359	2414	765	0	0	0	0	11
722	43	47	22	261	33	766	0	0	0	0	0
723	19564	24386	23352	10113	7685	767	0	0	0	0	0
724	786	1114	1249	694	759						

Table 11. Redfish survey biomass (t) with SD and stratified mean catch per tow (kg) and SD by year and Division in NAFO Div. 3NO: 1997-2015.

Div	Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
3NO	Biomass	5947	40909	76564	99226	63350	11172	15714	35275	157716	103029
	SD	988	20512	27740	33453	41460	2374	3224	7332	52646	23332
	MCPT	6.79	43.25	85.45	112.71	73.14	12.43	17.21	38.60	175.79	118.76
	SD	1.15	19.50	29.56	40.03	48.13	2.60	3.55	8.05	58.86	27.83
	N° Strata	36	41	41	41	41	41	41	41	41	41
3N	Biomass	4753	22540	46459	68928	53855	7620	11031	27016	146918	87830
	SD	353	17632	25022	33109	41371	2106	3199	7174	52267	22675
	MCPT	6.14	26.32	58.78	90.12	71.16	9.62	13.83	33.95	187.61	115.44
	SD	0.46	18.33	30.08	45.16	55.00	2.61	4.05	9.06	67.31	30.96
	N° Strata	27	31	31	31	31	31	31	31	31	31
3O	Biomass	1194	18369	30105	30298	9494	3552	4684	8259	10797	15199
	SD	922	10490	12129	6073	2702	1117	369	1326	2728	5279
	MCPT	11.41	159.86	269.16	268.32	86.80	31.74	40.55	70.63	94.35	141.64
	SD	8.68	87.87	107.03	54.27	24.47	9.78	3.10	11.68	24.19	52.04
	N° Strata	9	10	10	10	10	10	10	10	10	10
3N/Total (%) Biomass		80	55	61	69	85	68	70	77	93	85

Div	Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
3NO	Biomass	98805	74172	763980	431296	487655	294033	458716	190832	557954
	SD	15893	26168	145765	69575	107982	62954	76825	54478	143611
	MCPT	125.66	82.20	670.46	506.43	543.17	320.52	502.58	240.24	628.14
	SD	20.19	29.14	172.93	81.06	124.68	72.27	79.94	69.17	164.37
	N° Strata	36	41	39	37	41	41	41	41	41
3N	Biomass	87602	68059	735743	359536	418305	265238	429532	178055	523461
	SD	15364	25890	143334	58306	99454	60304	76128	54133	143235
	MCPT	124.79	86.51	721.67	473.94	533.85	330.89	539.18	256.34	669.86
	SD	22.09	33.12	194.48	76.53	132.71	80.20	91.06	79.00	187.34
	N° Strata	28	31	30	29	31	31	31	31	31
3O	Biomass	11203	6113	28238	71760	69350	28795	29184	12778	34493
	SD	3362	3258	16762	37821	41858	16754	7503	3927	12527
	MCPT	132.90	52.55	280.98	772.76	607.40	249.04	250.43	129.36	340.74
	SD	39.93	28.27	163.87	402.81	362.85	140.90	64.52	39.61	125.38
	N° Strata	8	10	9	8	10	10	10	10	10
3N/Total (%) Biomass		89	92	96	83	86	90	94	93	94

Table 12. Redfish length weight relationships in Spanish Spring Surveys in NAFO Div. 3NO: 2011-2015. E(x) means Error of the parameter x.

Males							Females						Total					
Year	a	b	E(a)	E(b)	R2	N	a	b	E(a)	E(b)	R2	N	a	b	E(a)	E(b)	R2	N
2011	0.01148	0.10130	3.0459	0.0311	0.997	524	0.0131	0.1267	3.01034	0.0386	0.995	588	0.0047	0.1154	3.30791	0.0368	0.995	1235
2012	0.01148	0.12340	2.9031	0.0371	0.998	341	0.0167	0.1631	2.94082	0.049	0.996	418	0.0158	0.1171	2.95433	0.0351	0.998	759
2013	0.01306	0.13360	2.98309	0.0409	0.994	482	0.0149	0.1068	2.95412	0.0312	0.997	479	0.0106	0.0838	3.04983	0.0263	0.997	1017
2014	0.01117	3.05050	0.0736	0.0234	0.998	424	0.0136	2.9921	0.1084	0.0318	0.997	387	0.0113	3.0464	0.0625	0.0199	0.998	821
2015	0.00757	3.17016	0.1274	0.0387	0.995	517	0.0087	3.1206	0.1057	0.0315	0.997	502	0.0073	3.1798	0.092	0.0283	0.997	1095

Table 13. Redfish mean number per tow by year in Spanish Spring surveys in NAFO Div. 3NO: 1997-2015. Indet. means indeterminate.

	1997				1998				1999				2000				2001			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
MNPT	22.38	14.94	0.00	37.32	108.36	114.09	0.02	222.47	289.50	200.84	0.39	490.73	518.31	326.79	0.00	845.10	279.45	158.85	1.10	439.41
	2002				2003				2004				2005				2006			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
MNPT	46.49	37.53	1.05	85.06	71.00	46.21	0.82	118.03	122.61	94.97	19.57	237.15	573.80	502.15	95.21	1171.16	398.90	293.94	247.70	940.54
	2007				2008				2009				2010				2011			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
MNPT	368.68	313.47	3.01	685.15	329.78	259.80	2.00	591.59	3754.48	2846.50	3.64	6604.62	2009.91	1807.51	0.23	3817.65	2385.24	1906.21	9.10	4300.55
	2012				2013				2014				2015							
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total				
MNPT	1184.89	981.01	0.31	2166.20	2034.96	1542.08	0.38	3577.42	742.09	639.39	0.41	1381.88	2120.95	1721.56	11.42	3853.93				

Table 14. Redfish mean number per tow by length class and year. Spanish Spring Survey on NAFO 3NO: 2011-2015. Indet. means indeterminate.

Length (cm)	2011				2012				2013				2014				2015			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.022	0.000	0.000	0.174	0.174
6	0.000	0.000	0.174	0.174	0.000	0.000	0.039	0.039	0.000	0.000	0.327	0.327	0.064	0.000	0.085	0.150	0.000	0.000	9.091	9.091
8	0.000	0.000	0.155	0.155	0.000	0.000	0.182	0.182	0.427	0.000	0.056	0.482	0.021	0.000	0.106	0.127	0.000	0.000	2.003	2.003
10	0.000	0.074	0.177	0.251	0.000	0.000	0.077	0.077	0.247	0.000	0.000	0.247	0.010	0.000	0.201	0.211	0.000	0.094	0.046	0.140
12	0.990	0.456	1.294	2.741	0.004	0.036	0.008	0.049	0.207	0.000	0.000	0.207	0.034	0.008	0.000	0.042	0.010	0.000	0.065	0.075
14	11.860	8.726	7.290	27.876	1.181	1.981	0.000	3.162	0.329	0.000	0.000	0.329	0.147	0.000	0.000	0.147	0.729	0.061	0.036	0.826
16	61.607	64.245	0.007	125.860	23.574	5.428	0.000	29.001	4.075	1.763	0.000	5.838	2.111	3.014	0.000	5.125	1.054	0.190	0.000	1.244
18	766.590	365.669	0.000	1132.259	191.476	74.149	0.000	265.624	152.717	45.982	0.000	198.698	57.245	17.786	0.000	75.031	97.663	29.361	0.000	127.025
20	1215.754	991.597	0.000	2207.351	715.886	393.611	0.000	1109.497	1266.873	551.383	0.000	1818.256	353.948	126.173	0.000	480.121	960.679	291.918	0.000	1252.597
22	219.501	310.021	0.000	529.522	167.953	303.957	0.000	471.910	496.753	707.239	0.000	1203.992	242.008	252.294	0.000	494.302	803.867	668.544	0.000	1472.411
24	85.212	73.057	0.000	158.269	50.679	80.796	0.000	131.475	71.268	143.489	0.000	214.758	63.344	135.739	0.000	199.083	171.811	428.572	0.000	600.384
26	17.255	39.551	0.000	56.806	23.257	40.965	0.000	64.222	24.290	44.182	0.000	68.472	18.428	42.912	0.000	61.340	72.813	151.935	0.000	224.748
28	4.258	28.841	0.000	33.099	7.073	43.349	0.000	50.422	3.186	23.874	0.000	27.060	2.230	31.128	0.000	33.358	3.194	78.432	0.000	81.626
30	0.384	17.283	0.000	17.667	1.459	23.110	0.000	24.569	5.827	16.799	0.000	22.626	0.866	18.874	0.000	19.740	1.919	46.678	0.000	48.597
32	0.460	4.280	0.000	4.740	0.653	6.588	0.000	7.241	2.200	4.369	0.000	6.569	0.468	8.424	0.000	8.891	3.066	18.828	0.000	21.894
34	0.585	1.460	0.000	2.045	0.567	3.613	0.000	4.179	1.655	1.804	0.000	3.459	0.483	1.840	0.000	2.324	2.027	4.225	0.000	6.252
36	0.479	0.639	0.000	1.118	0.629	2.010	0.000	2.639	4.402	0.781	0.000	5.183	0.456	0.877	0.000	1.332	0.944	1.598	0.000	2.542
38	0.195	0.237	0.000	0.431	0.368	0.495	0.000	0.863	0.291	0.293	0.000	0.584	0.138	0.203	0.000	0.340	0.760	0.756	0.000	1.516
40	0.113	0.030	0.000	0.143	0.119	0.056	0.000	0.175	0.126	0.070	0.000	0.196	0.060	0.084	0.000	0.144	0.391	0.198	0.000	0.590
42	0.000	0.036	0.000	0.036	0.007	0.006	0.000	0.013	0.085	0.046	0.000	0.131	0.015	0.018	0.000	0.033	0.024	0.112	0.000	0.137
44	0.000	0.007	0.000	0.007	0.000	0.000	0.000	0.000	0.004	0.004	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.054	0.000	0.054
46	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
48	0.000	0.000	0.000	0.000	0.000	0.860	0.000	0.860	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.011	0.000	0.000	0.000	0.000
52	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
54	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.000	0.011	0.000	0.000	0.000	0.000
Total	2385.243	1906.208	9.097	4300.549	1184.885	981.008	0.306	2166.200	2034.960	1542.077	0.383	3577.420	742.086	639.385	0.414	1381.885	2120.954	1721.558	11.415	3853.927
Nº samples:				44				43				51				46				43
Nº Ind.:	3845	3633	241	7719	4019	3986	40	8045	4182	4210	34	8426	2851	3000	27	5878	3508	4328	1318	9154
Sampled catch:				1524				1517				1726				1230				1977
Range:				6-45				7-49				6-45				5-54				5-44
Total catch:				95569				50184				78332				42046				93699
Total hauls:				122				122				122				122				122

Table 15. Witch flounder mean catch (kg) and SD by stratum. Spanish Spring Surveys in NAFO Div. 3NO: 2011-2015. n.s. means stratum not surveyed.

Stratum	2011		2012		2013		2014		2015	
	W. flounder	W. flounder	W. flounder	W. flounder	W. flounder	W. flounder	W. flounder	W. flounder	W. flounder	W. flounder
	Mean catch	SD	Mean catch	SD	Mean catch	SD	Mean catch	SD	Mean catch	SD
353	2.41	1.95	16.99	26.78	11.01	10.52	4.03	0.67	3.83	3.32
354	5.13	4.97	4.02	1.78	9.32	9.37	1.89	0.86	2.15	2.69
355	3.29	0.30	3.16	1.89	0.05	0.07	0.64	0.07	2.05	0.06
356	0.51	0.35	0.42	0.60	0.85	0.78	0.45	0.64	3.85	5.35
357	1.99	1.53	1.08	1.52	0.42	0.59	0.63	0.88	0.96	0.25
358	3.06	1.64	7.32	7.14	2.61	1.01	3.97	3.83	4.60	4.48
359	4.28	3.67	10.55	10.81	10.92	16.98	1.91	2.51	18.27	21.53
360	1.19	3.60	3.93	9.01	1.36	2.90	0.17	0.37	0.35	0.63
374	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
375	0.00	0.00	0.26	0.45	0.00	0.00	0.00	0.00	0.00	0.00
376	0.00	0.00	0.01	0.04	0.11	0.23	0.00	0.00	0.00	0.00
377	0.00	0.00	0.00	0.00	0.45	0.63	0.00	0.00	0.78	1.10
378	0.00	0.00	0.18	0.25	0.52	0.74	1.06	1.49	2.83	2.07
379	0.18	0.26	0.64	0.48	0.00	0.00	0.92	0.14	0.29	0.40
380	0.22	0.30	0.72	1.01	0.38	0.53	1.41	1.99	0.73	0.10
381	1.81	0.57	3.38	4.78	1.12	0.93	0.00	0.00	1.24	1.18
382	0.00	0.00	0.00	0.00	0.56	0.74	0.21	0.42	0.00	0.00
721	2.01	1.84	0.75	0.42	0.91	0.17	0.61	0.86	0.76	0.22
722	0.72	0.61	0.60	0.78	2.69	0.22	1.66	0.52	1.19	0.08
723	5.93	2.88	1.55	0.04	2.39	1.88	5.32	3.26	4.71	1.86
724	8.23	7.44	14.94	19.04	8.61	7.74	4.17	0.64	8.16	4.06
725	2.09	1.02	1.48	0.46	5.05	3.16	2.58	2.07	7.12	5.54
726	7.45	5.56	3.51	2.07	18.48	15.11	4.89	2.10	2.95	0.26
727	3.55	3.91	6.47	9.15	10.31	1.20	3.00	4.24	0.78	0.52
728	8.07	3.58	17.53	3.19	8.38	9.72	11.94	9.54	11.70	7.50
752	1.29	1.83	1.80	1.98	4.85	6.86	7.85	11.10	9.88	5.51
753	1.06	1.50	0.00	0.00	0.70	0.99	1.20	0.26	0.81	1.13
754	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
755	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
756	7.74	4.11	4.73	6.24	5.21	7.37	9.31	6.52	5.15	3.29
757	1.73	2.45	1.60	1.81	5.29	1.22	5.92	8.37	3.29	4.65
758	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
759	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
760	8.66	7.10	7.82	10.16	6.63	7.71	3.42	4.30	16.15	20.72
761	5.58	7.07	5.99	5.46	2.30	2.61	0.93	0.18	2.61	0.94
762	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.64
763	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
764	1.35	0.38	0.99	0.45	5.16	3.17	0.58	0.23	0.68	0.14
765	0.68	0.60	0.16	0.22	0.26	0.02	0.76	0.82	0.37	0.24
766	0.35	0.49	0.27	0.06	0.00	0.00	0.12	0.16	0.25	0.35
767	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 16. Witch flounder survey biomass (t) by stratum in NAFO Div. 3NO: 2011-2015. n.s. means stratum not surveyed.

Strata	2011	2012	2013	2014	2015	Strata	2011	2012	2013	2014	2015
353	56	406	255	86	77	725	18	14	46	21	65
354	110	88	204	35	41	726	48	23	120	28	19
355	21	20	0	4	12	727	30	53	86	22	7
356	2	2	4	2	14	728	55	120	56	75	81
357	29	15	6	8	13	752	14	21	55	86	115
358	60	150	52	69	89	753	13	0	8	14	10
359	157	386	388	62	630	754	0	0	0	0	0
360	280	933	323	36	82	755	0	0	0	0	0
374	0	0	0	0	0	756	76	43	46	82	46
375	0	6	0	0	0	757	15	15	45	50	29
376	0	1	12	0	0	758	0	0	0	0	0
377	0	0	4	0	7	759	0	0	0	0	0
378	0	2	6	11	35	760	125	107	89	43	221
379	2	6	0	8	3	761	81	93	35	13	37
380	2	6	3	10	6	762	0	0	0	0	8
381	22	44	13	0	15	763	0	0	0	0	0
382	0	0	16	6	0	764	12	9	48	4	5
721	11	4	5	3	4	765	8	2	3	8	4
722	5	5	20	11	8	766	4	3	0	1	3
723	84	21	33	64	63	767	0	0	0	0	0
724	88	165	95	41	86						

Table 17. Witch flounder survey biomass (t) with SD and stratified mean catch per tow (kg) and SD by year and Division in NAFO Div. 3NO: 2002-2015.

Year	2002	2003	2004	2005	2006	2007	2008
Biomass	1784	3145	3348	2633	2570	1480	2118
SD	426	690	523	488	629	229	481
MCPT	2.00	3.42	3.66	2.95	3.01	1.84	2.32
SD	0.49	0.75	0.56	0.56	0.73	0.28	0.52

Year	2009	2010	2011	2012	2013	2014	2015
Biomass	1872	3239	1428	2763	2078	903	1834
SD	423	777	248	648	367	134	376
MCPT	2.13	3.82	1.58	3.06	2.32	1.09	2.11
SD	0.48	0.91	0.28	0.74	0.41	0.16	0.42

Table 18. Witch flounder length weight relationships in Spanish Spring Surveys in NAFO Div. 3NO: 2011-2015. E(x) means Error of the parameter x.

Year	Males						Females						Total					
	a	b	E(a)	E(b)	R2	N	a	b	E(a)	E(b)	R2	N	a	b	E(a)	E(b)	R2	N
2011	0.00153	3.40467	0.2368	0.0681	0.991	180	0.00147	3.41280	0.1470	0.0418	0.995	344	0.00162	3.38866	0.1040	0.0333	0.997	529
2012	0.00202	3.31917	0.1945	0.0557	0.996	199	0.00147	3.39880	0.1746	0.0484	0.997	281	0.00162	3.38866	0.1171	0.0346	0.998	487
2013	0.00108	3.48692	0.1785	0.0532	0.994	286	0.00109	3.48450	0.0815	0.0234	0.998	563	0.00220	3.28882	0.1559	0.0480	0.991	864
2014	0.00060	3.65925	0.2494	0.0709	0.991	134	0.00096	3.52772	0.1025	0.0286	0.998	278	0.00217	3.30510	0.1540	0.0440	0.994	415
2015	0.00103	3.51249	0.1701	0.0489	0.995	306	0.00154	3.39857	0.0807	0.0230	0.998	440	0.00206	3.31598	0.1112	0.0329	0.996	762

Table 19. Witch flounder mean number per tow by year in Spanish Spring Surveys in NAFO Div. 3NO: 2002-2015. Indet. means indeterminate.

	2002				2003				2004				2005				2006			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
MNPT	2.602	3.488	0.459	6.548	4.499	5.864	0.057	10.420	4.182	6.088	0.211	10.480	4.160	5.570	0.605	10.336	3.384	4.937	0.040	8.360
	2007				2008				2009				2010				2011			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
MNPT	1.952	3.050	0.061	5.063	2.061	3.384	0.027	5.472	2.352	4.107	0.043	6.502	3.538	5.411	0.000	8.949	1.326	2.529	0.033	3.887
	2012				2013				2014				2015							
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total				
MNPT	3.350	4.078	0.056	7.483	2.009	3.908	0.159	6.076	0.756	1.626	0.012	2.395	1.941	2.810	0.125	4.875				

Table 20. Witch flounder mean number per tow by length class and year. Spanish Spring Surveys in NAFO Div. 3NO: 2011-2015. Indet. means indeterminate.

Lenght (cm.)	2011				2012				2013				2014				2015			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.003	0.000	0.019	0.022	0.000	0.000	0.005	0.005	0.000	0.000	0.048	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.064	0.064
8	0.000	0.003	0.013	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.050	0.050	0.000	0.000	0.004	0.004	0.000	0.000	0.042	0.042
10	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.014	0.008	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.011	0.005	0.000	0.008	0.012	0.000	0.003	0.000	0.003	0.000	0.008	0.000	0.008
14	0.000	0.005	0.000	0.005	0.000	0.000	0.020	0.020	0.002	0.015	0.000	0.017	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.009
16	0.010	0.025	0.000	0.035	0.009	0.006	0.006	0.021	0.011	0.021	0.000	0.032	0.000	0.000	0.004	0.004	0.000	0.007	0.000	0.007
18	0.023	0.023	0.000	0.046	0.004	0.002	0.000	0.007	0.010	0.049	0.016	0.074	0.000	0.004	0.004	0.009	0.022	0.018	0.000	0.040
20	0.003	0.025	0.000	0.028	0.013	0.013	0.000	0.025	0.024	0.002	0.016	0.042	0.004	0.014	0.000	0.018	0.006	0.000	0.000	0.006
22	0.015	0.006	0.000	0.022	0.009	0.031	0.000	0.039	0.052	0.025	0.011	0.087	0.003	0.007	0.000	0.010	0.016	0.014	0.000	0.030
24	0.010	0.013	0.000	0.023	0.024	0.030	0.000	0.054	0.055	0.078	0.011	0.144	0.014	0.008	0.000	0.022	0.010	0.025	0.000	0.036
26	0.020	0.016	0.000	0.036	0.070	0.022	0.000	0.092	0.079	0.057	0.000	0.136	0.027	0.020	0.000	0.047	0.037	0.004	0.000	0.042
28	0.032	0.047	0.000	0.079	0.116	0.125	0.000	0.241	0.093	0.141	0.000	0.233	0.054	0.036	0.000	0.090	0.057	0.058	0.000	0.115
30	0.115	0.084	0.000	0.199	0.262	0.138	0.000	0.400	0.168	0.158	0.000	0.326	0.030	0.078	0.000	0.108	0.118	0.114	0.000	0.232
32	0.186	0.146	0.000	0.332	0.345	0.222	0.000	0.567	0.263	0.260	0.000	0.524	0.066	0.090	0.000	0.156	0.179	0.099	0.000	0.278
34	0.222	0.205	0.000	0.426	0.431	0.323	0.000	0.755	0.245	0.372	0.000	0.617	0.096	0.136	0.000	0.232	0.245	0.196	0.004	0.445
36	0.214	0.276	0.000	0.490	0.474	0.324	0.000	0.798	0.261	0.379	0.000	0.640	0.103	0.124	0.000	0.227	0.352	0.259	0.000	0.611
38	0.235	0.293	0.000	0.528	0.556	0.437	0.000	0.993	0.289	0.348	0.000	0.637	0.125	0.168	0.000	0.293	0.339	0.268	0.000	0.607
40	0.179	0.308	0.000	0.487	0.514	0.570	0.000	1.085	0.234	0.417	0.000	0.652	0.141	0.170	0.000	0.311	0.358	0.423	0.000	0.781
42	0.051	0.365	0.000	0.416	0.358	0.610	0.000	0.969	0.143	0.522	0.000	0.665	0.056	0.204	0.000	0.260	0.110	0.384	0.004	0.497
44	0.009	0.388	0.000	0.397	0.148	0.582	0.000	0.730	0.058	0.442	0.000	0.500	0.025	0.220	0.000	0.246	0.040	0.377	0.007	0.425
46	0.000	0.171	0.000	0.171	0.012	0.433	0.000	0.445	0.000	0.386	0.000	0.386	0.012	0.174	0.000	0.186	0.026	0.262	0.000	0.287
48	0.000	0.065	0.000	0.065	0.004	0.142	0.000	0.146	0.009	0.154	0.000	0.163	0.000	0.067	0.000	0.067	0.016	0.176	0.004	0.196
50	0.000	0.058	0.000	0.058	0.000	0.053	0.000	0.053	0.000	0.046	0.000	0.046	0.000	0.067	0.000	0.067	0.000	0.063	0.000	0.063
52	0.000	0.007	0.000	0.007	0.000	0.006	0.000	0.006	0.000	0.029	0.000	0.029	0.000	0.022	0.000	0.022	0.000	0.042	0.000	0.042
54	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.005	0.000	0.012	0.000	0.012
56	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.007	0.000	0.000	0.000	0.000
58	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
62	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
64	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	1.326	2.529	0.033	3.887	3.350	4.078	0.056	7.483	2.009	3.908	0.159	6.076	0.756	1.626	0.012	2.395	1.941	2.810	0.125	4.875
N° samples:				64				67				67				53				69
N° Ind.:	193	377	5	575	392	541	11	944	315	592	25	932	131	271	3	405	304	443	21	768
Sampled catch:				220				398				330				188				336
Range:				7-52				7-55				6-58				8-57				7-54
Total catch:				235				398				356				189				346
Total hauls:				122				122				122				122				122

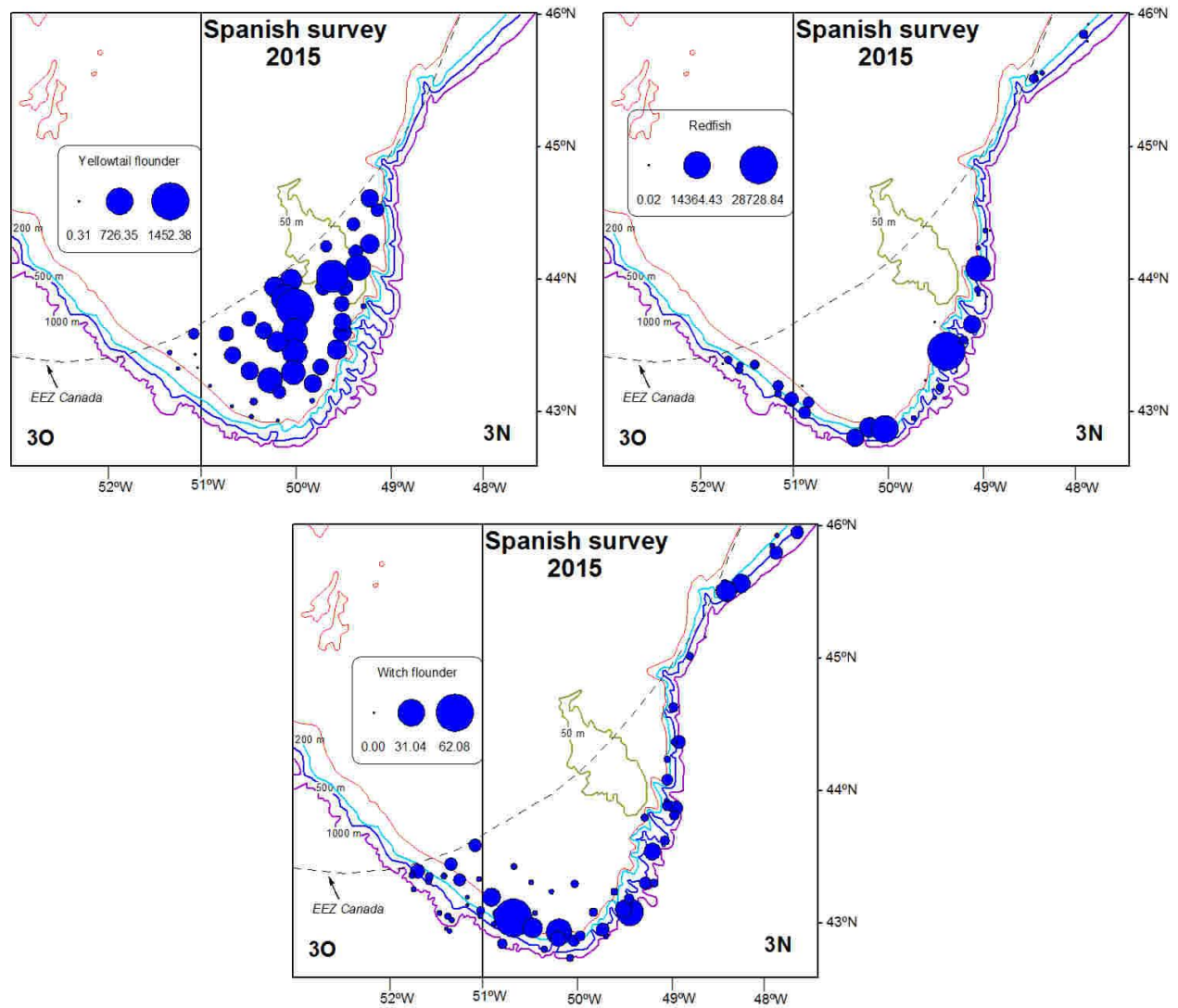


Fig. 1. Position of the hauls and the catch of yellowtail flounder, redfish and witch flounder during the 2015 Spanish 3NO survey. Note that the scale is different in the three graphs.

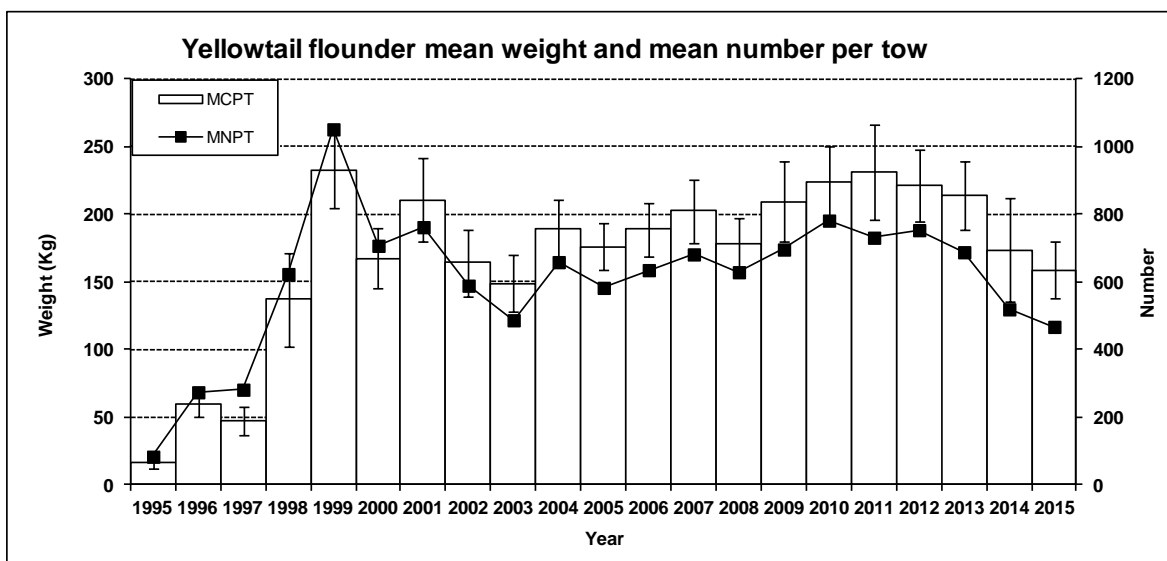


Fig. 2. Yellowtail flounder stratified mean catches in Kg and \pm SD by year and mean number by year. Spanish Spring surveys in NAFO Div. 3NO: 1995-2015.

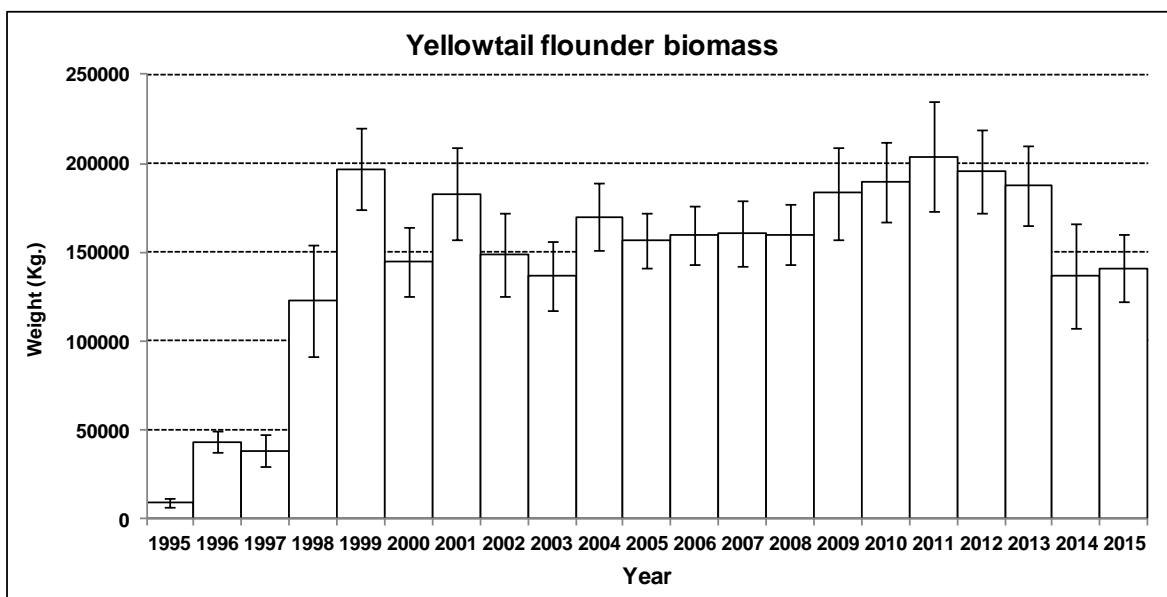


Fig. 3. Yellowtail flounder biomass calculated by the swept area method in tons and \pm SD by year. Spanish Spring surveys in NAFO Div. 3NO: 1995-2015.

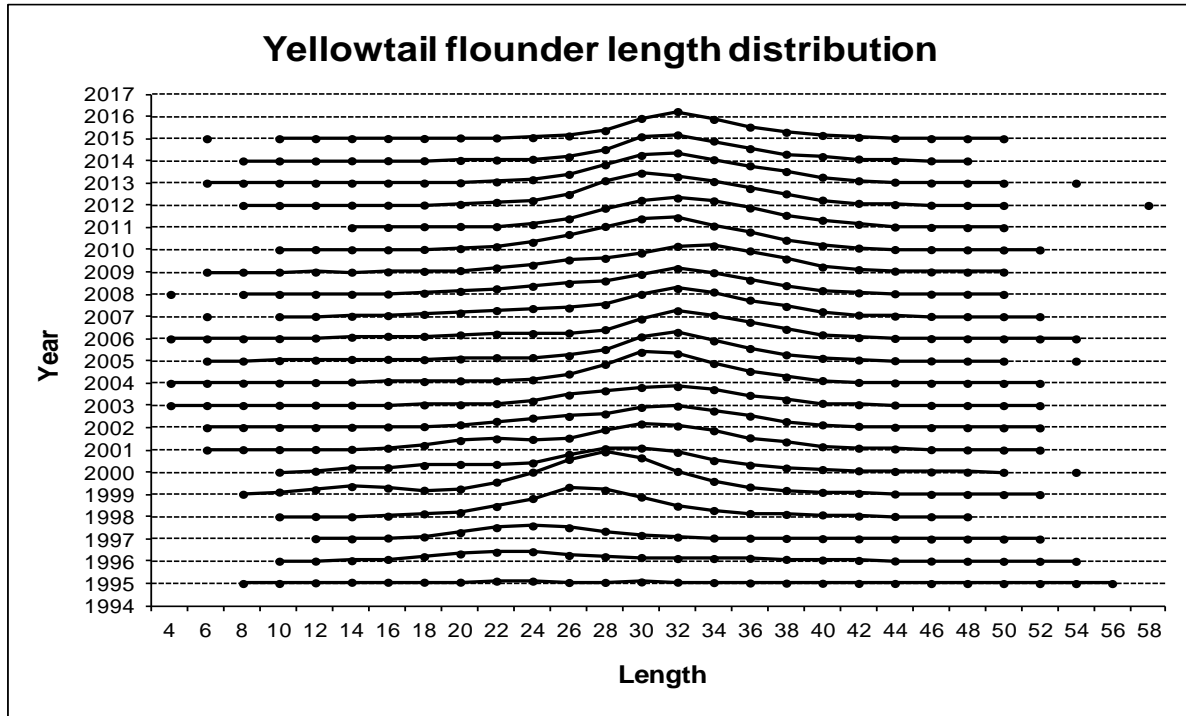


Fig. 4. Yellowtail flounder mean catches per tow length distribution (cm) on NAFO 3NO: 1995-2015. Data from 2011 to 2015 are in Table 8; data for 1995-2010 can be seen in SCR Doc 13/11.

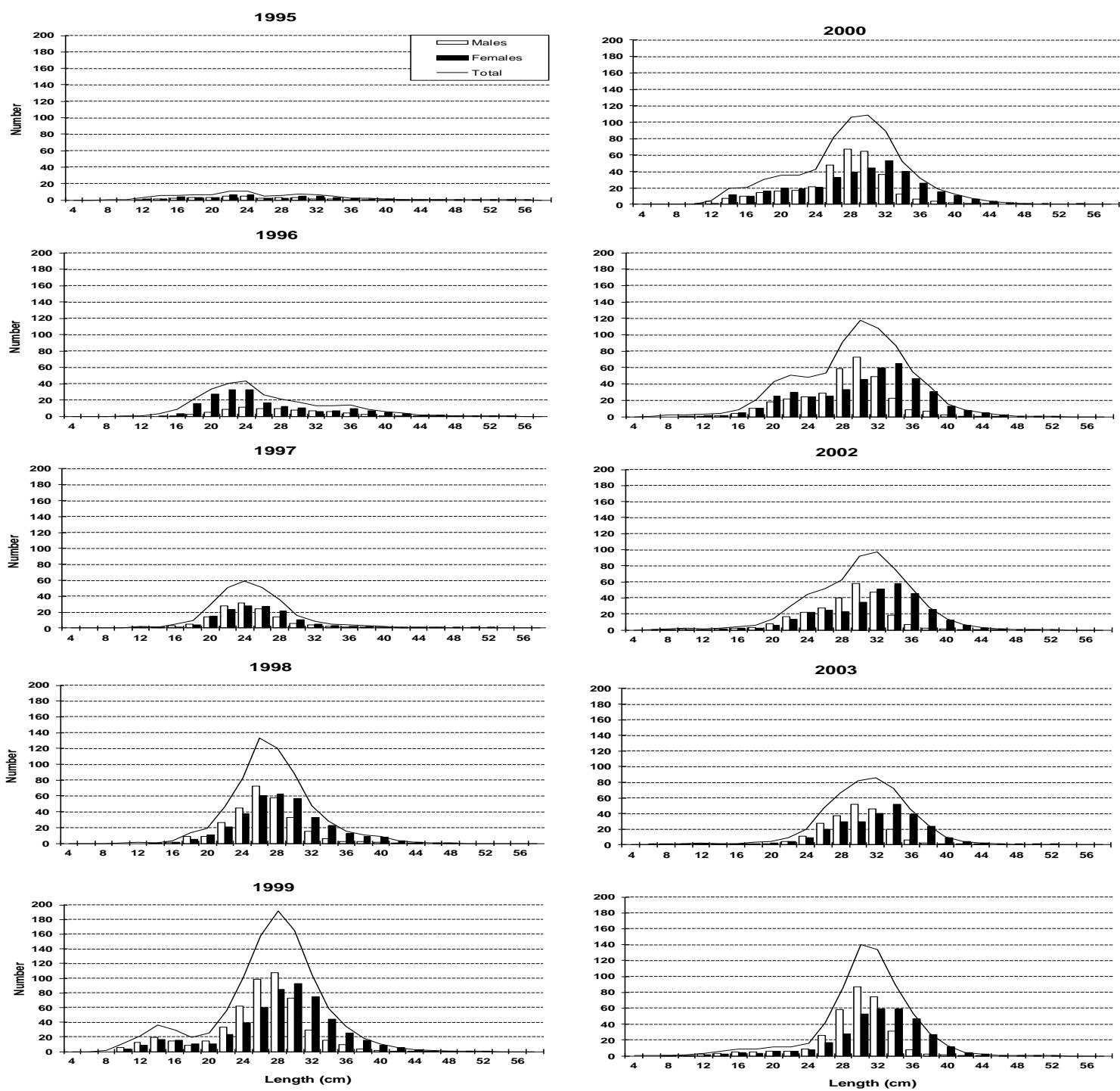


Fig. 5. Yellowtail flounder length distribution (cm) on NAFO 3NO: 1995-2015. Mean catches per tow number. Data from 2011 to 2015 are in Table 8; data for 1995-2010 can be seen in SCR Doc 13/11.

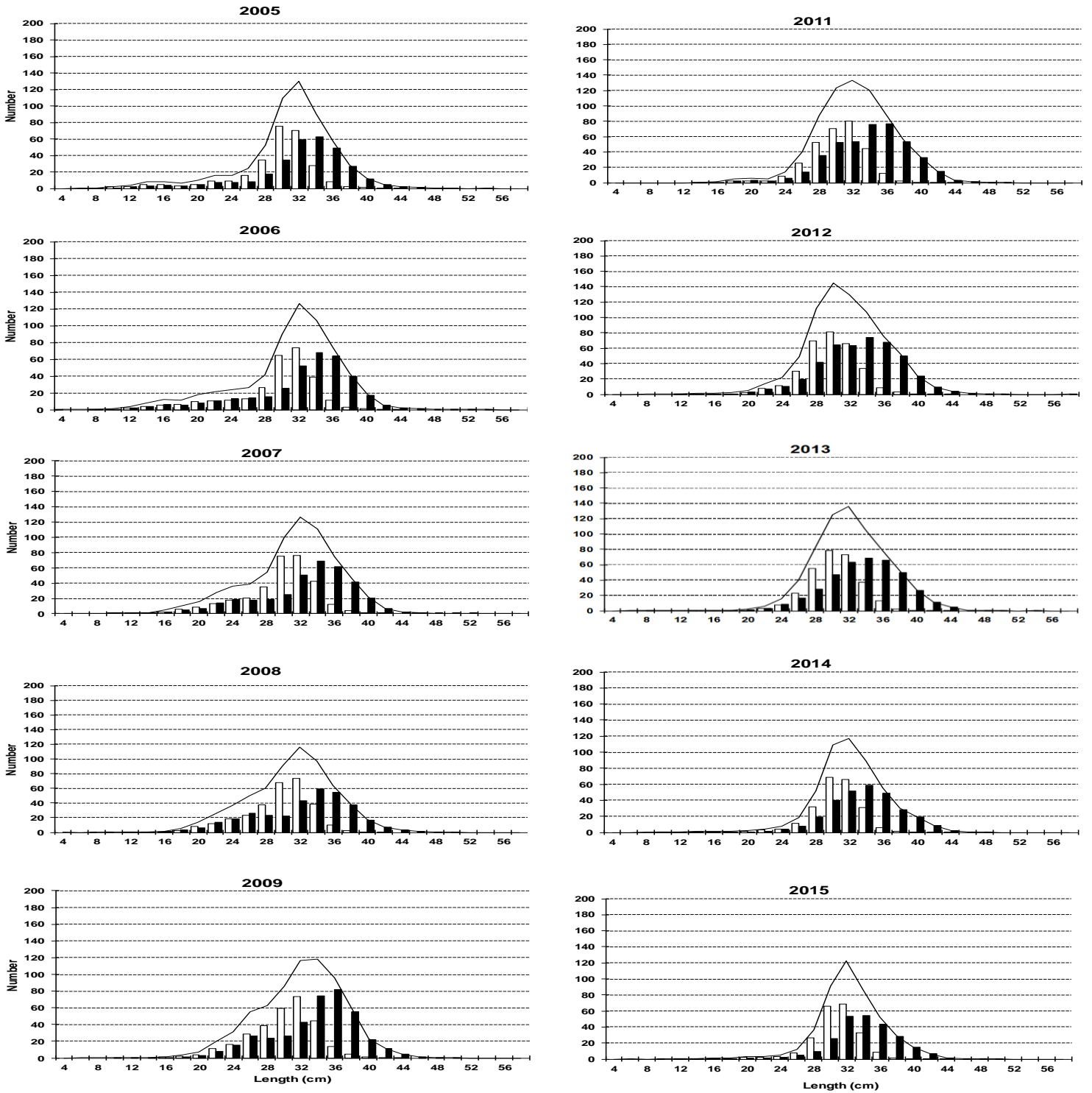


Fig. 5 (cont.). Yellowtail flounder length distribution (cm) on NAFO 3NO: 1995-2015. Mean catches per tow number. Data from 2011 to 2015 are in Table 8; data for 1995-2010 can be seen in SCR Doc 13/11.

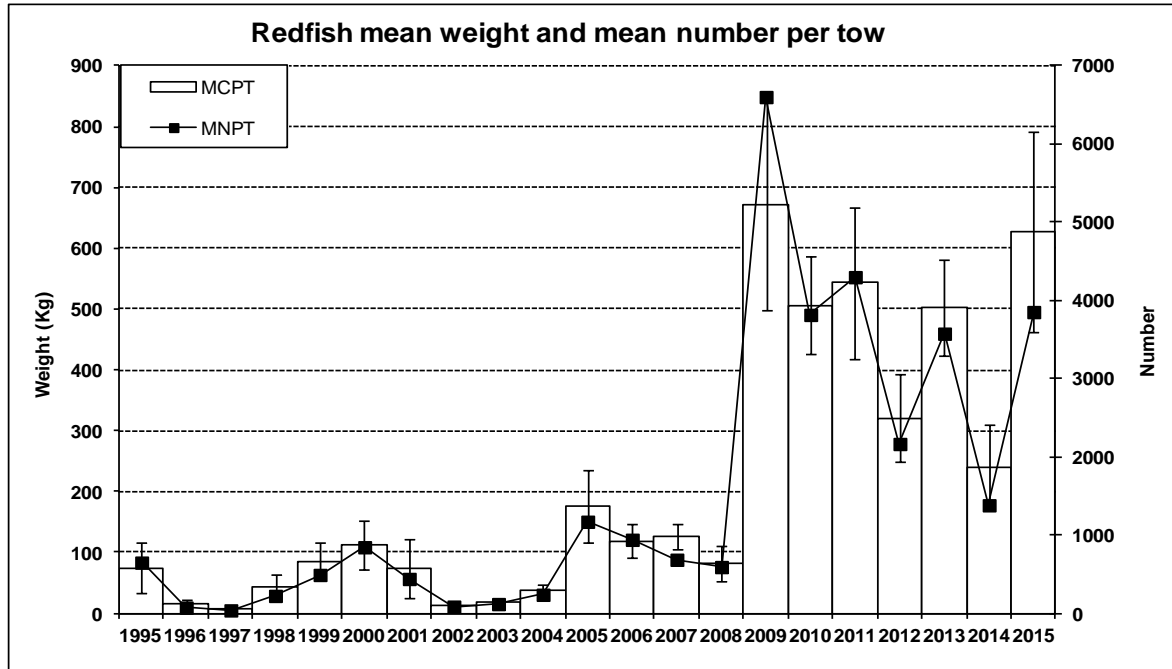


Fig. 6. Redfish stratified mean catches in Kg and \pm SD by year and mean number by year. Spanish Spring surveys in NAFO Div. 3NO: 1997-2015.

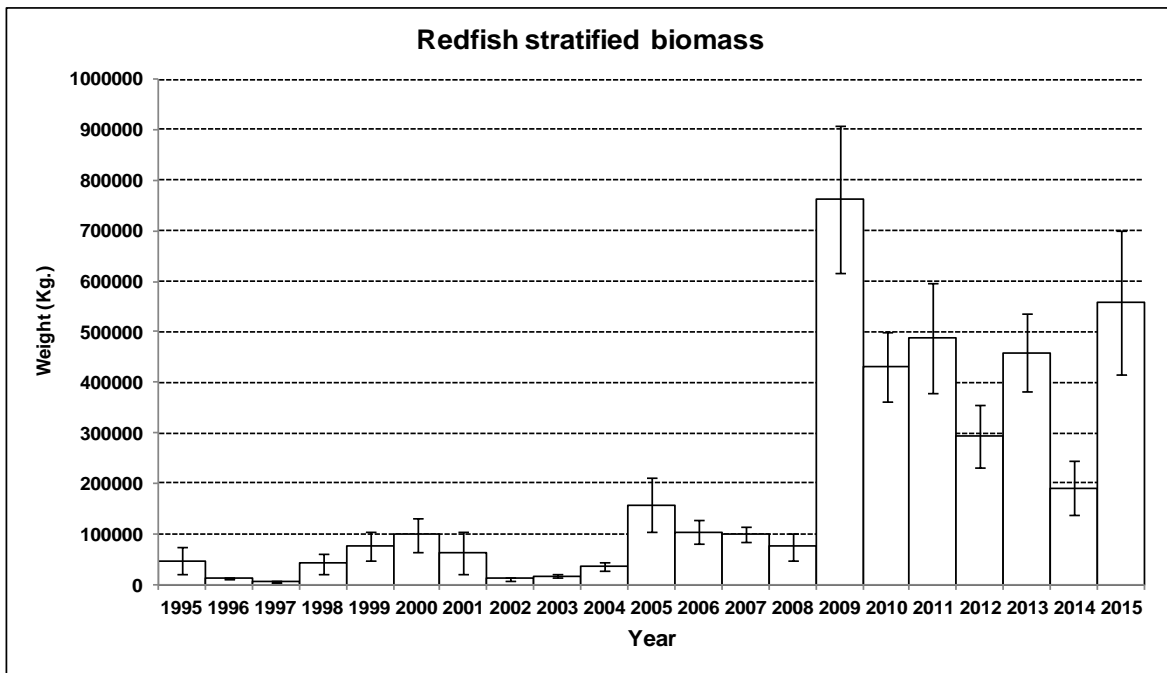


Fig. 7. Redfish biomass calculated by the swept area method in tons and \pm SD by year. Spanish Spring surveys in NAFO Div. 3NO: 1997-2015.

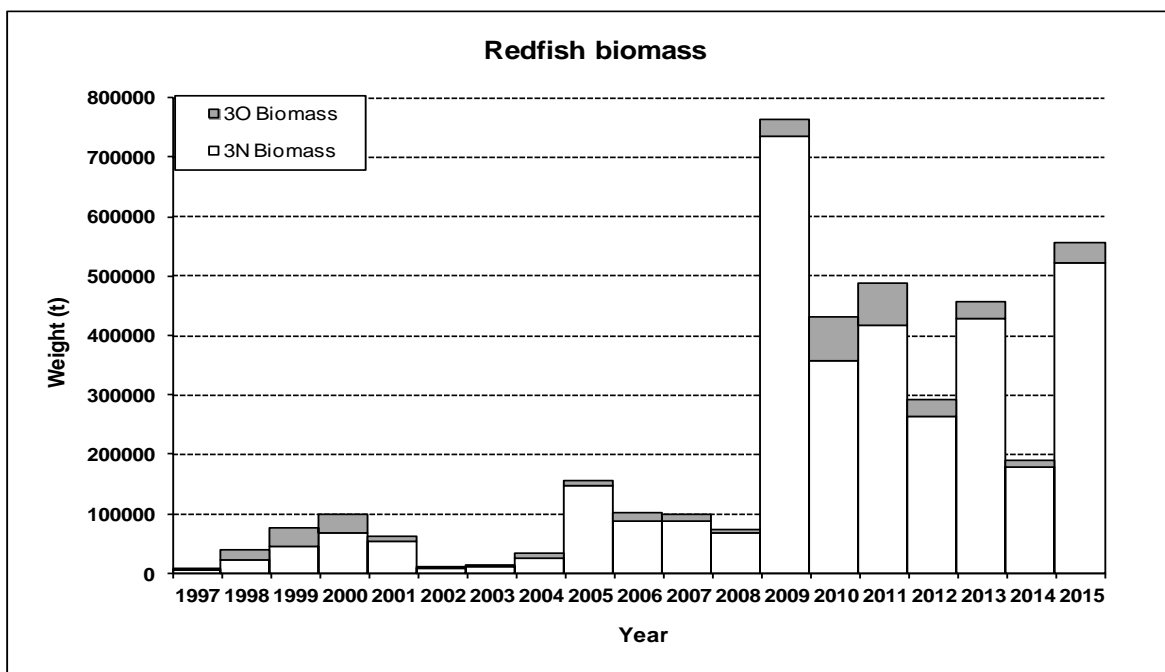


Fig. 8. Redfish biomass calculated by the swept area method in tons by year and Division. Spanish Spring surveys in NAFO Div. 3NO: 1997-2015.

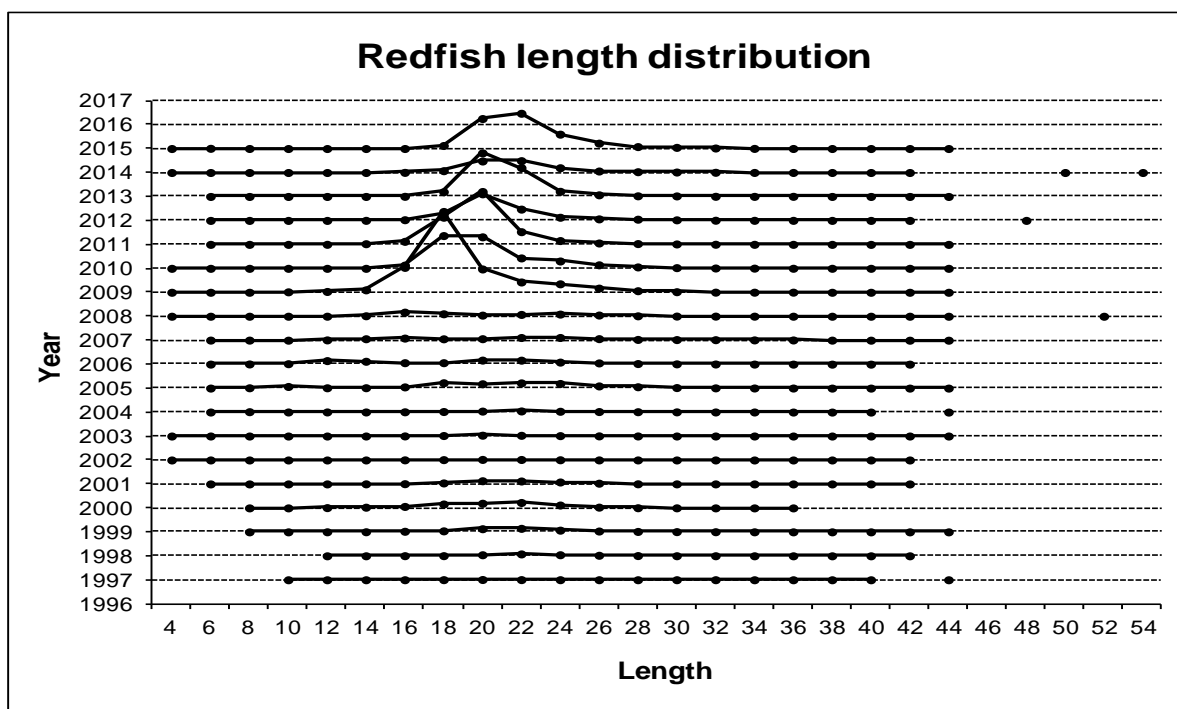


Fig. 9. Redfish mean catches per tow length distribution (cm) on NAFO 3NO: 1997-2015. Data from 2011 to 2015 are in Table 14; the data for 1997-2010 can be seen in SCR Doc 13/11.

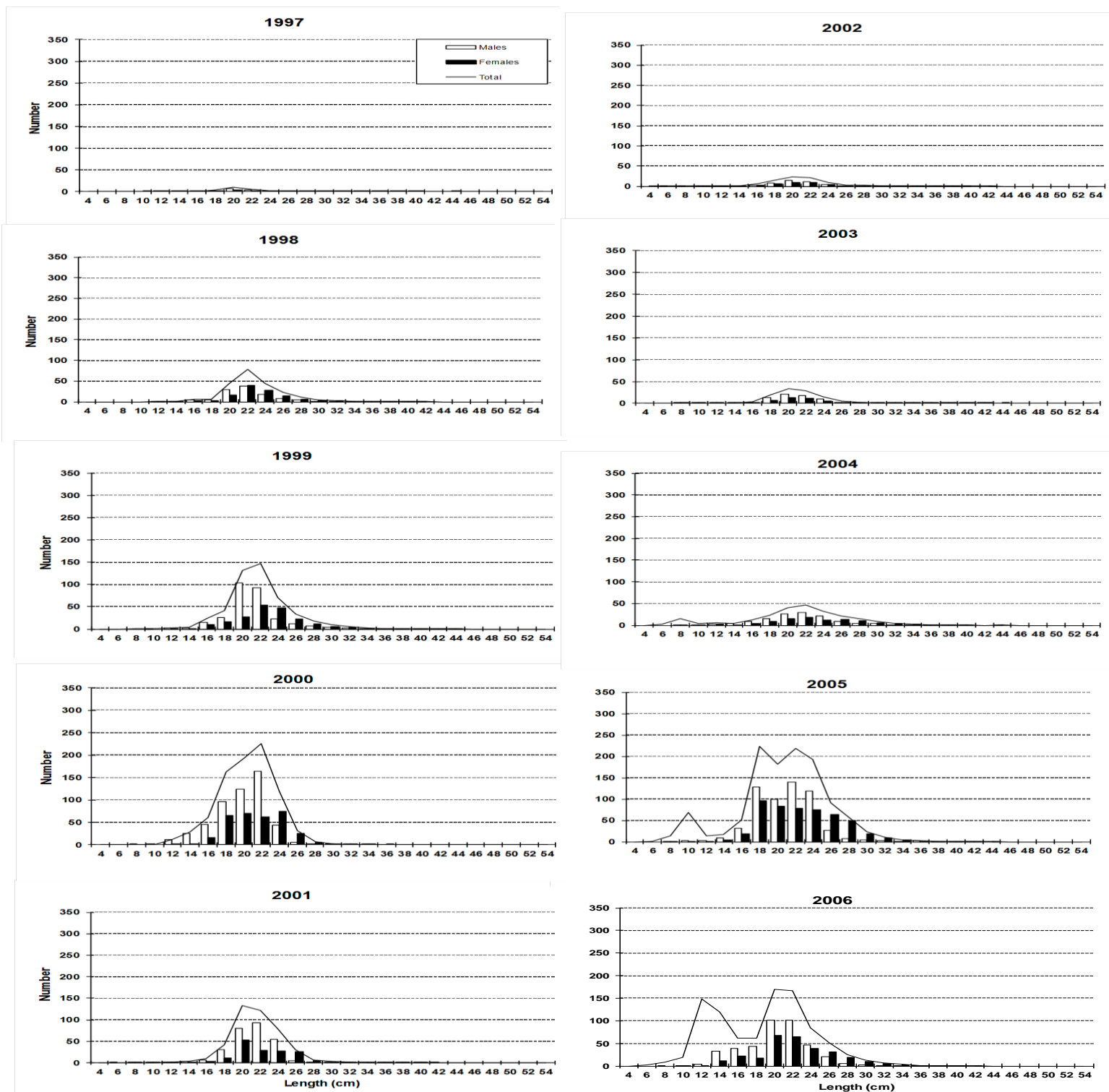


Fig. 10. Redfish length distribution (cm) on NAFO 3NO: 1997-2015. Mean catches per tow number. Data from 2011 to 2015 are in Table 14; the data for 1997-2010 can be seen in SCR Doc 13/11.

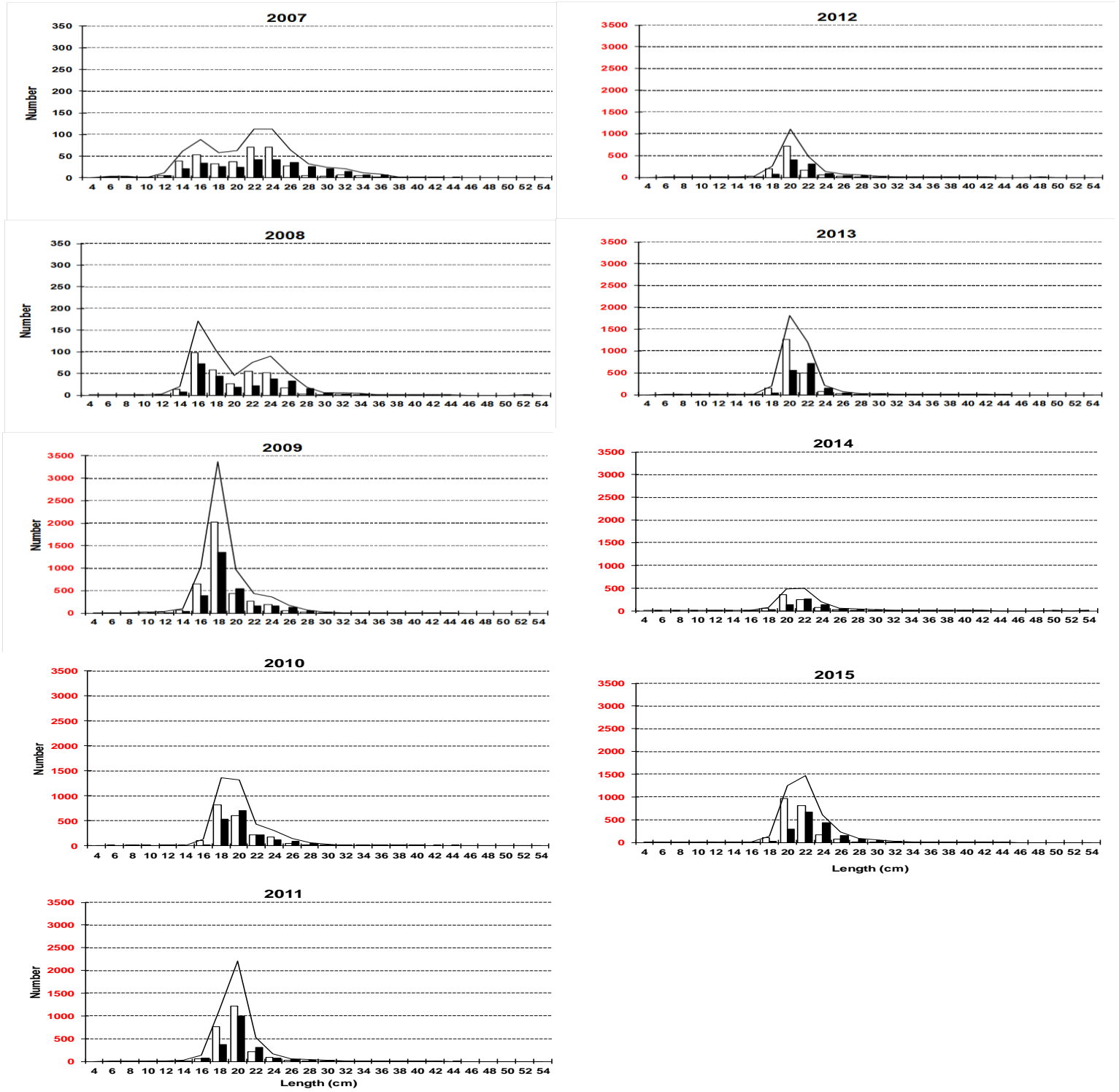


Fig. 10 (cont.). Redfish length distribution (cm) on NAFO 3NO: 1997-2015. Mean catches per tow number. The data from 2011 to 2015 is in Table 8; the data for 1997-2010 can be seen in SCR Doc 13/11. The 2009-2015 graphs have a different y-axis upper limit.

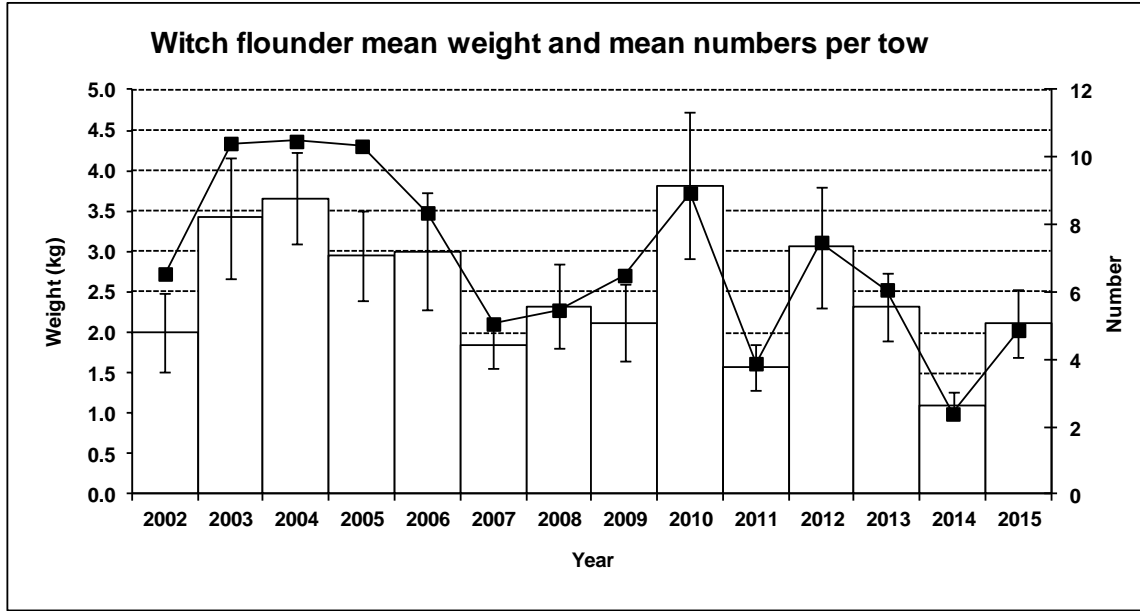


Fig. 11. Witch flounder stratified mean catches in Kg and \pm SD by year and mean number by year. Spanish Spring surveys in NAFO Div. 3NO: 2002-2015.

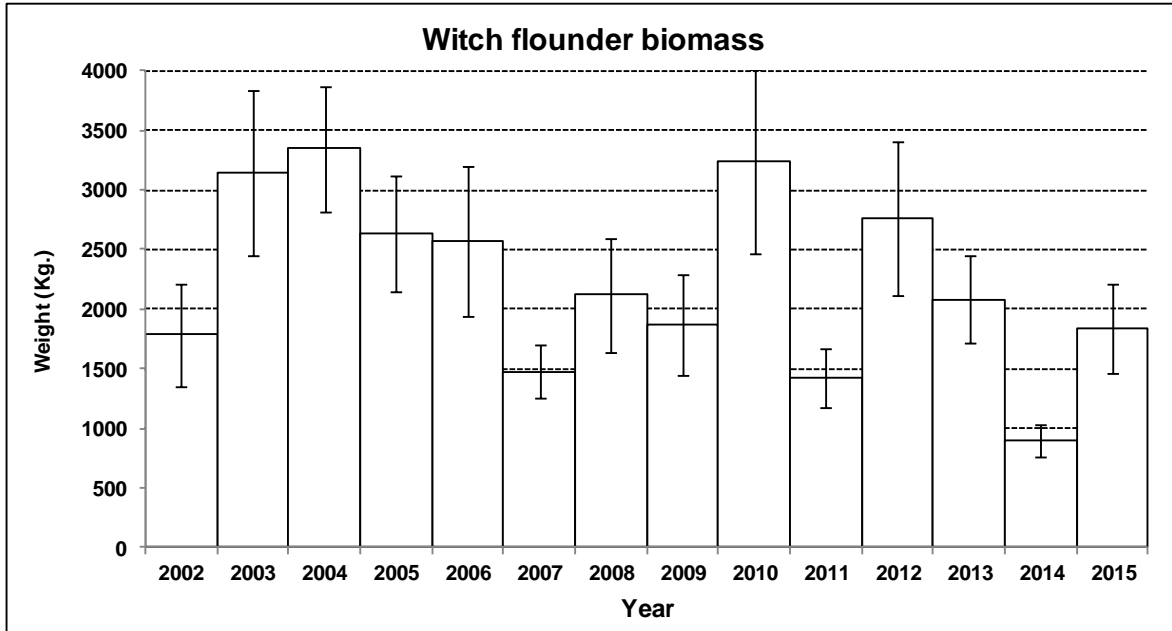


Fig. 12. Witch flounder biomass calculated by the swept area method in tons and \pm SD by year. Spanish Spring surveys in NAFO Div. 3NO: 2002-2015.

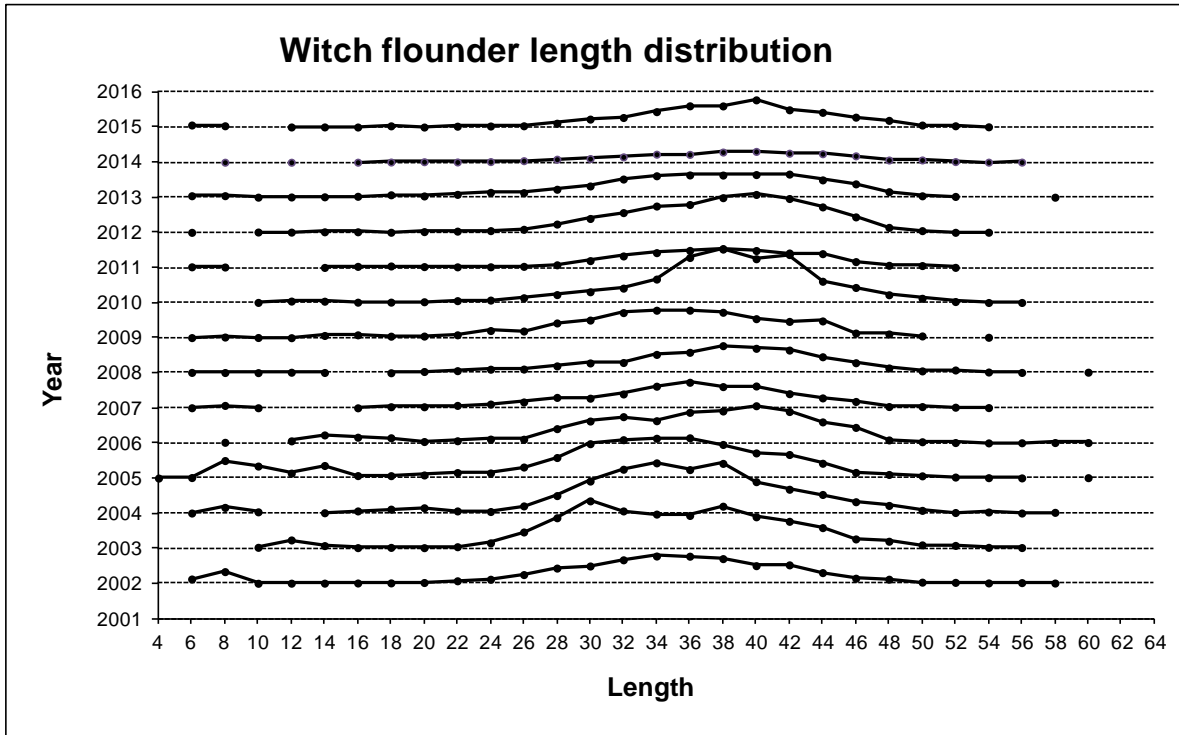


Fig. 13. Witch flounder mean catches per tow length distribution (cm) on NAFO 3NO: 2002-2015. Data from 2011 to 2015 are in Table 20; data for 1997-2010 can be seen in SCR Doc 13/11.

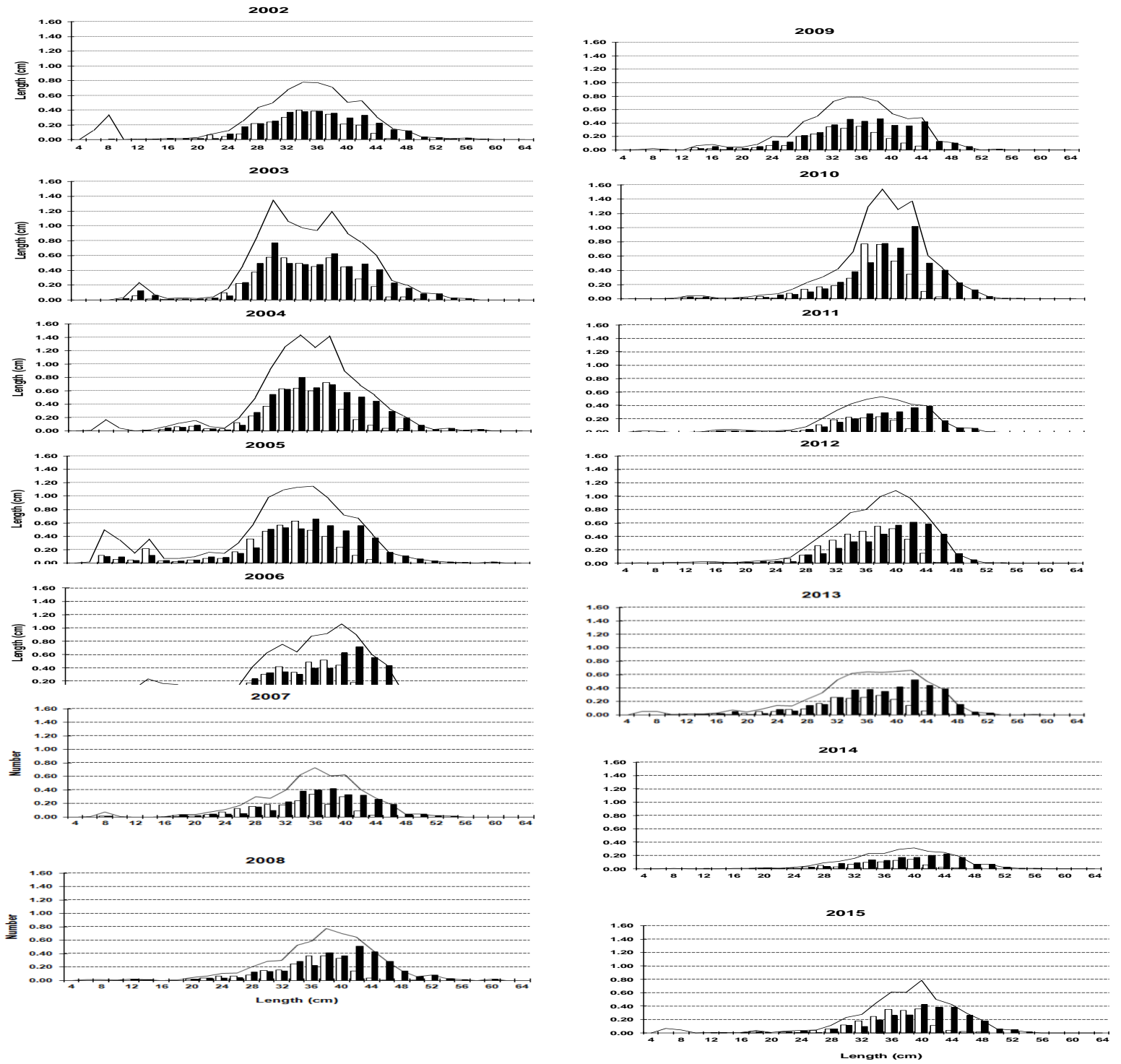


Fig. 14. Witch flounder length distribution (cm) on NAFO 3NO: 2002-2015. Mean catches per tow numbers. Data from 2011 to 2015 are in Table 20; data for 1997-2010 can be seen in SCR Doc 13/11.